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REVIEW

A systematic approach for analysis, interpretation, and reporting of coronary CTA studies

Christoph A. Karlo · Sebastian Leschka · Paul Stolzmann · Nicola Glaser-Gallion · Simon Wildermuth · Hatem Alkadhi

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Abstract Over the past years, the number of coronary computed tomography angiography (CTA) studies performed worldwide has been steadily increasing. Performing a coronary CTA study with appropriate protocols tailored to the individual patient and clinical question is mandatory to obtain an image quality that is diagnostic for the study purpose. This process can be considered the primary mainstay of each coronary CTA study. The secondary mainstay is represented by the correct analysis and interpretation of the acquired data, as well as reporting of the pertinent imaging findings to the referring physician. The latter process requires knowledge of the advantages and disadvantages of various post-processing methods. In addition, a standardized approach can be helpful to avoid false-positive and false-negative findings regarding the presence or absence of coronary artery disease. By implementing various radiation dose reduction techniques, care needs to be taken to keep the radiation dose of coronary CTA as low as reasonably achievable while maintaining the diagnostic capacity of the examination. This review describes a practical approach to the analysis and interpretation of coronary CTA data, including the standardized reporting of the relevant imaging findings to the referring physicians.

Keywords Computed tomography · Angiography · Coronary artery disease · Systematic approach · CTA

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Introduction

Coronary computed tomography angiography (CTA) has entered the level of daily clinical practice in many institutions worldwide. Virtually all previously performed studies on the diagnostic accuracy of coronary CTA have shown a high sensitivity and high negative predictive value indicating the ability of this noninvasive method to exclude relevant morphological coronary artery disease [1–3]. The implementation of coronary CTA into the guidelines and recommendations of various national and international societies and the development of appropriateness criteria for clarifying the indications for coronary CTA have further enhanced its growing clinical role for the diagnosis or exclusion of coronary artery disease [4–6].

Due to the increasing acceptance of this highly demanding, noninvasive imaging method, coronary CTA has become relevant for a large number of radiologists/cardiologists with previously limited knowledge in interpreting cardiac imaging studies. For the less experienced reader, relevant coronary artery lesions could easily be missed, nonrelevant coronary stenoses could be overestimated as being significant (i.e., particularly in the presence of severely calcified deposits [7]), and artefacts might be mistaken for real lesions resulting in false-positive classifications. The correct interpretation of coronary CTA studies with avoidance of false-negative findings is important because the high negative predictive value of coronary CTA is one of the main strengths of this method, and patients with normal CT scans usually do not need to undergo further cardiac imaging tests [8, 9]. Also, false-positive results from coronary CTA may lead to invasive work-up that could have been avoided if the initial interpretation had been correct.

A large number of studies have described the various protocols available, their individual use depending on the patient's habitus and heart rate, and the different post-processing options [10, 11]. Interestingly, studies detailing the analysis and interpretation as well as reporting the data are conspicuously rare.

Hence, this review describes an approach for analyzing, interpreting, and reporting coronary CTA through a proposed systematic approach. A focus is on the avoidance of false-positive and false-negative findings, so as to exploit the full diagnostic capabilities of this noninvasive imaging test.

Protocols

Detailed descriptions of various protocols have been previously provided [12–14]. Briefly, coronary CTA begins with the appropriate patient selection with regard to the symptoms in combination with the clinical history and cardiovascular risk profile. After selecting the patient, preparation including the administration of beta-blockers and/or nitroglycerine needs to be taken into account, including considerations about contraindications for the drugs [15]. After placement of an intravenous line for contrast media administration that is large enough to handle the high flow rates (around 5–6 ml/s) of contrast media, the protocol needs to be selected. The protocol has to take into account the heart rate, body mass index (or body weight), as well as the age of the patient, including a reflection of the clinical question at hand such as whether the coronaries, bypass grafts, valves, ventricular function, or aortic root are to be targeted. Depending on the CT machine and CT generation, the data should be acquired by using a retrospectively electrocardiography (ECG)-gated spiral mode [3, 16], a prospectively ECG-gated protocol (also known as sequential or step-and-shoot mode) [1, 13, 14], or a prospectively ECG-gated spiral acquisition with high-pitch [17–19]. High image quality is the key feature for a correct diagnosis and goes along with a reduction in the time needed for interpretation of the CT data. Another important aspect is related to the radiation dose of the examination, which is tightly linked to the protocol used [10, 20].

Optimizing radiation dose

The increasing use of radiation-associated cardiac imaging tests such as coronary CTA has led to a substantial increase in radiation dose applied to the population. Therefore, when planning for and performing coronary CTA studies, it is imperative to consider radiation dose reduction strategies. First, the indication of coronary CTA has to be assessed with strict adherence to common guidelines and recommendations. Then, the radiation dose applied to the individual patient needs to be lowered to a level that is as low as reasonably achievable (ALARA). When performing retrospectively ECG-gated, 64-slice coronary CTA, radiation dose values of up to 21 mSv have been reported, while average effective doses of this technique are in the range of 15 mSv [21–23]. Today, the following strategies for minimizing radiation dose of coronary CTA are available, which alone or in combination help to reduce the radiation dose of each study:

1. ***ECG-based tube current modulation***, decreasing the non-diastolic tube current by 75–96%. Thus, the effective radiation dose of retrospectively ECG-gated CTA can be lowered to around 8–10 mSv [24, 25].
2. ***Lowering the tube voltage***, leading to higher attenuation values of iodinated contrast medium. By reducing the tube voltage from 120 to 100 kV, radiation dose may be further reduced to 6.5 mSv when using retrospectively ECG-gated CTA with ECG-controlled tube current modulation in patients with a body mass index below 25 kg/m^2 [26, 27].
3. ***Prospective ECG-gating*** (i.e., step-and-shoot mode), applying radiation dose during the diastole only and therefore resulting in radiation dose estimates of 1.5–4 mSv in patients with low heart rates (i.e., below 65 or 70 bpm) [28].
4. ***Prospectively ECG-gated high-pitch mode***, acquiring the data in spiral mode while the table is moved at a high pitch of 3.4 at most. In this way, the entire heart can be covered within one single cardiac cycle (i.e., usually during diastole). The effective radiation dose may be as low as 1 mSv [18, 29, 30].

Reconstructions

Detailed descriptions of the available reconstruction options for each protocol, taking into account the average heart rate and the variability during data acquisition, have been published in a considerable number of studies [11, 14, 31]. Reconstructions of data acquired in the retrospective spiral mode can be performed either using a fraction of the R-R interval or an absolute time-point prior to or following the R-wave of each cardiac cycle, the latter showing some advantages in case of variable heart rates and arrhythmia.

Initially, a multi-phase series from 10 to 100% of the R-R interval can be reconstructed. This series—usually reconstructed in 10% steps—is required for further ventricular and valvular analyses and facilitates easy identification of the optimal cardiac %-phase with no or as few as possible motion artefacts. Since the least coronary artery motion occurs during mid- to end-diastole [32], initial reconstructions for the assessment of coronary arteries should be performed at 60–80% of the cardiac cycle in patients with heart rates between 60 and 70 beats per minute (bpm) [31, 33, 34]. When using an absolute time-point, images at 350, 400, and 450 ms prior to the R-wave should be reconstructed [35]. However, in patients with higher heart rates or greater heart rate variability, reconstructions from image data acquired during the systole may be beneficial (i.e., around 20–30% of the cardiac cycle). The definition of the beginning of percentage steps differs among the vendors of different CT scanners. Thus, it is important to be aware of these definitions and best reconstruction intervals for the CT machine at hand.

Various CT machines provide an automatic selection of the best reconstruction phase in systole and diastole, determined by motion path mapping. Use of these automated tools helps in a time-efficient analysis of the coronary CTA data by having the data set with best image quality immediately available without reviewing all reconstructed data stacks.

Evaluation of extra-cardiac structures within the scan field-of-view is essential [36, 37]. Therefore, additional reconstructions in a soft- and lung-tissue convolution filter encompassing the entire lung, osseous thoracic cage, and mediastinum should be performed and evaluated by a radiologist with expertise in thoracic imaging to avoid missing relevant pathologic findings of the thorax.

Post-processing

All post-processing of coronary CTA data should be performed by imaging experts (i.e., radiologists, cardiologists, or technologists) who are familiar with cardiac anatomy and pathology using dedicated software. First of all, the original source images (i.e., raw data) need to be reconstructed using the thinnest section thickness possible (i.e., 0.6 or 0.625 mm depending on CT system and data acquisition algorithm). The resulting transverse (i.e., axial) images may then be used to perform the following post-processing techniques:

1. ***Multi-planar reformations (MPR)*** display the dataset in any imaging plane of the three-dimensional space. MPR are easily reconstructed and may be saved and archived to PACS (picture archive and communications system) for further analysis if desired. If reconstructed along a vessel centerline (i.e., “curved” MPR), the depiction of even long and tortuous coronary arteries is possible on a single image. Curved MPR are considered very important for the diagnosis, depiction, and illustration of coronary artery disease because usually the course of coronary arteries is tortuous and complex to view on one two-dimensional image. Curved MPR allow for a display of a whole vessel or coronary artery segment on one image, thus enabling the illustration of a coronary artery stenosis in its full extent (Fig. 1). In general, MPR may be reconstructed quickly on all common post-processing systems and are considered mandatory for the diagnosis of coronary artery disease because a coronary stenosis should be validated on a second imaging plane in all cases to avoid false-positive findings.
2. ***Maximum intensity projections (MIP)*** display the voxels of highest attenuation within a volume in the direction of view providing an angiography-like image. Thus, MIP allow for the reconstruction of a vascular map quickly without the need for a complicated modification of multiple parameters. However, MIP may lead to overestimation of coronary stenosis caused by calcified plaque and should never be used to secure a diagnosis without cross-checking thin-section MPR.
3. ***Volume rendering technique (VRT)*** makes use of the entire data set thus providing a three-dimensional overview of the anatomy. VRT may be used to demonstrate an overview of coronary anatomy in case coronary artery anomalies are present. In addition, the vasculature of patients after bypass surgery can be nicely illustrated using the VRT technique. VRT, similar to MIP, should not be used to assess coronary stenoses, since the VRT image depends upon multiple parameters and coronary stenoses may easily be over- or underestimated.

Dedicated software systems for semi-automated segmentation of the coronary arteries are offered by most vendors today. These systems enable the user to mark a certain anatomical structure (i.e., most commonly the ascending aorta just above the coronary artery ostia) and the system then automatically detects the coronary arteries and their segments.

The standard transverse, coronal, and sagittal imaging planes are usually not appropriate for evaluating coronary CTA images because the coronary arteries mainly travel transverse and oblique to these planes. For evaluation of coronary anatomy, the following standardized planes are considered useful:

1. ***The short axis plane*** provides longitudinal views of the right coronary (RCA) and the circumflex artery (LCX) and perpendicular views of the left anterior descending artery (LAD).
2. ***The orthogonal long axis plane*** provides longitudinal views of the LAD, the posterior descending artery (PDA), and the middle parts of the RCA and LCX, and perpendicular views of the proximal and distal parts of the RCA and LCX.
3, ***The horizontal long axis plane*** provides longitudinal views of the LAD, the distal RCA, and the PDA, and perpendicular views of the middle parts of the RCA and LCX (Fig. 2).

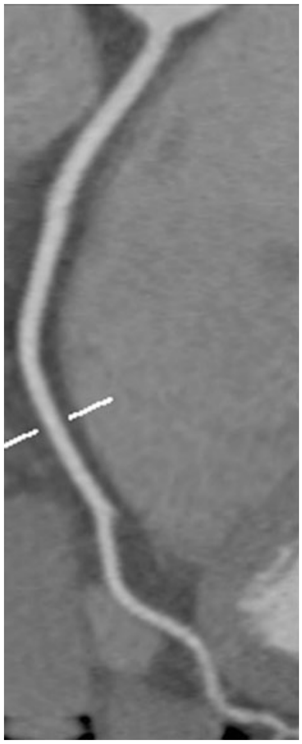


Fig. 1 Curved multi-planar reformations of the right coronary artery providing an excellent depiction of the vessel along its entire course

Analysis and interpretation

Coronary CTA data should be interpreted on a computer workstation capable of all post-processing methods listed above (i.e., MPR, MIP, and VRT). In contrast to CT studies of other body regions, it is not possible to establish an accurate diagnosis of coronary artery disease by interpreting transverse images alone. Instead, findings need to be validated on alternate imaging planes. A two-step systematic image analysis and interpretation algorithm for the assessment of coronary artery stenosis is illustrated in Fig. 3.

Evaluation of coronary arteries: step one

1. An overview of the coronary artery anatomy and image quality is obtained by scrolling through the transverse image stack, thus providing a first impression of possible difficulties owing to the presence of calcifications and potential artefacts. During this overview, coronary anatomy needs to be assessed carefully for possible coronary artery anomalies.
2. Thin-slab MIP images can be used for identification of plaques in the standard planes. The use of thin-slab MIP (with a slab thickness of 3–5 mm) provides a display of a longer portion of the vessel on a single image. Very thick MIP images with a slab thickness of more than 10 mm should not be used because findings could be missed, or false-positive findings could be introduced by dense structures adjacent to the coronary arteries (such as vessel wall calcifications or stents). Review of the transverse and thin-slab MIP images is performed to identify regions with vessel wall plaques that warrant further investigation.
3. Oblique MPR images parallel and orthogonal to the vessel centerline, including curved MPR images, should be used to assess all identified plaques in both planes. This is performed to assign a degree of stenosis to each plaque. Especially in the presence

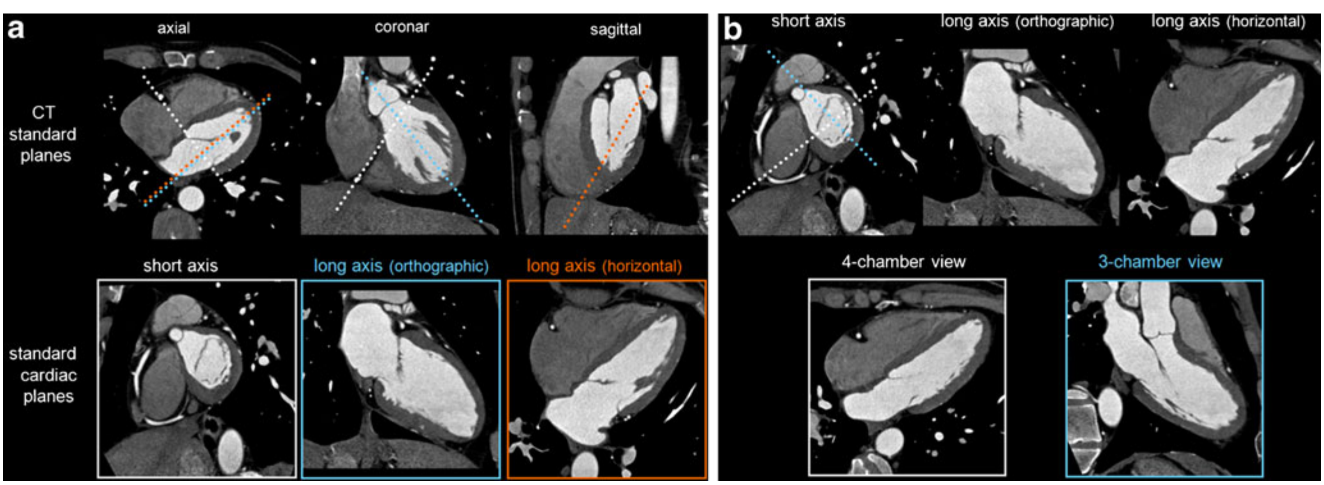


Fig. 2 **a** Guide for adjusting imaging planes from the CT standard planes to the standard cardiac planes [i.e., short axis (*white line*), orthographic long axis (*blue lines*), and horizontal long axis view (*orange lines*)]. **b** Guide for adjusting imaging planes from the standard cardiac planes to the "three- and four-chamber view." The four-chamber view is achieved by adjusting a perpendicular plane to the short axis crossing the middle of the mitral valve and the acute margin (*white line*). The three-chamber view is achieved by adjusting a perpendicular plane to the short axis crossing the middle of the mitral valve and the middle of the aortic valve (*blue line*)

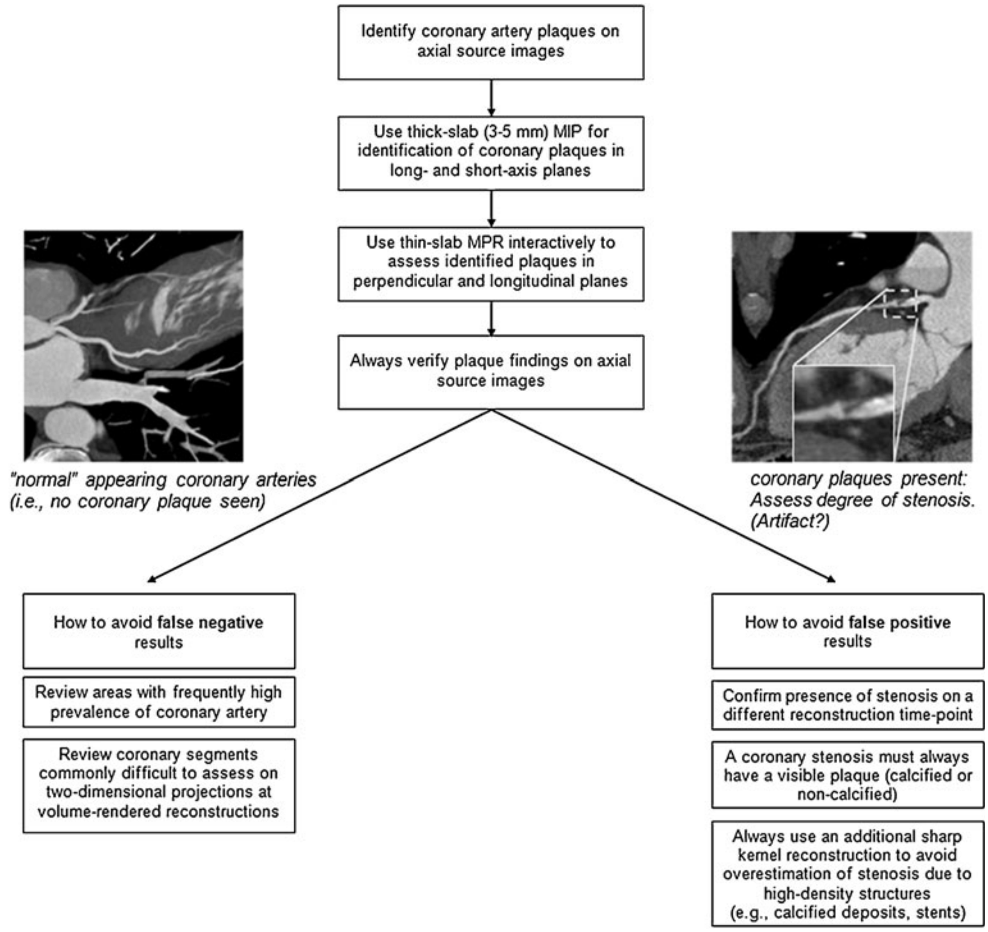
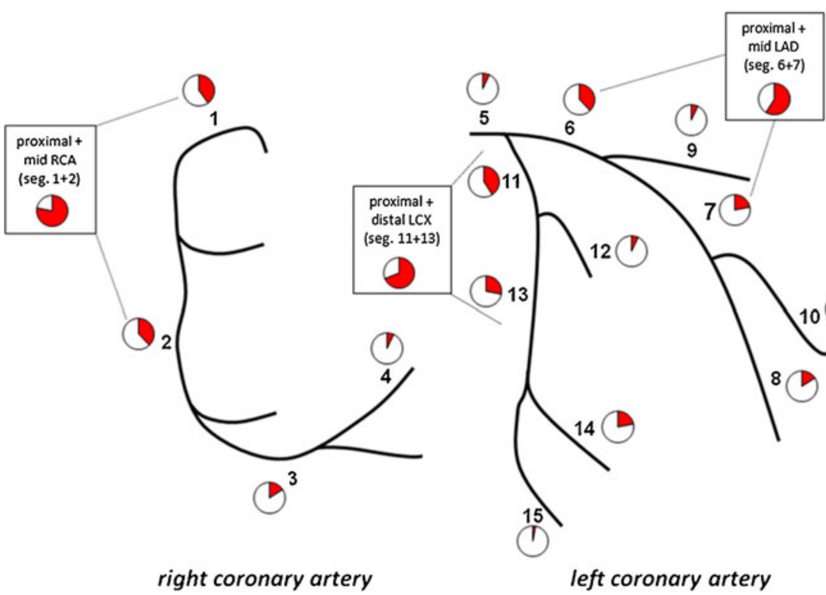


Fig. 3 Algorithm for coronary artery evaluation at coronary CTA

of coronary artery stents, the additional use of curved MPR through the stent midline facilitates better visualization of the lumen especially when the stented vessel has a tortuous course.

Evaluation of coronary arteries: step two

After completing those initial evaluation steps there are two possible results: the coronary arteries either appear normal,



segment number	segment name	rate of stenosis relative to all stenosed segments	rate of stenosis relative to stenosed segments in the coronary artery
seg. 1	***proximal RCA***	***10%***	***40%***
seg. 2	***mid RCA***	***9%***	***38%***
seg. 3	distal RCA	4%	16%
seg. 4	right posterior descending artery	2%	7%
seg. 5	left main artery	4%	8%
seg. 6	***proximal LAD***	***17%***	***37%***
seg. 7	***mid LAD***	***10%***	***22%***
seg. 8	distal LAD	3%	6%
seg. 9	first diagonal artery	8%	16%
seg. 10	second diagonal artery	3%	6%
seg. 11	***proximal LCX***	***12%***	***41%***
seg. 12	obtuse marginal branch	2%	7%
seg. 13	***distal LCX***	***8%***	***28%***
seg. 14	***first posterolateral branch***	***6%***	***22%***
seg. 15	left posterior descending artery	1%	3%
seg. 16	intermedial artery	2%	4%

Fig. 4 Prevalence of relevant coronary artery stenoses in the different coronary segments

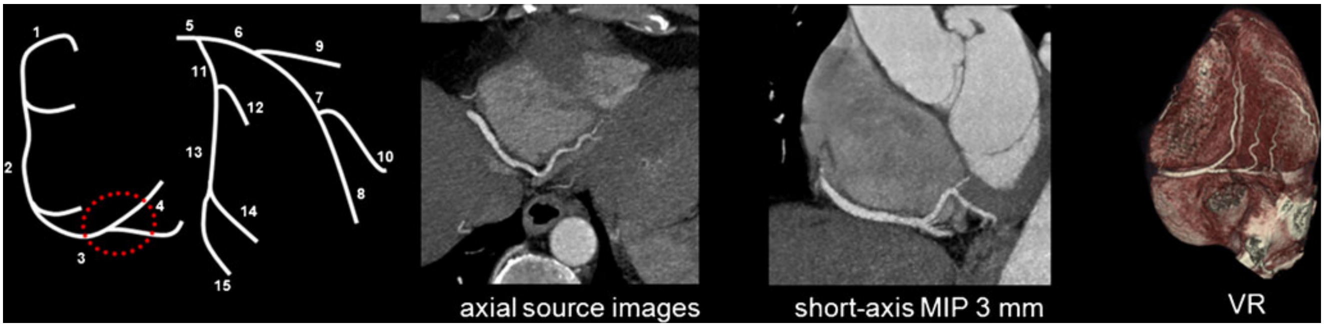


Fig. 5 Review segments and bifurcations where lesions are often missed: distal RCA/PDA (*MIP* maximum intensity projections, *VR* volume rendering)

showing no plaques and stenoses, or plaques and/or stenoses are identified. Based on these two possible results, the second interpretation step is aimed at avoiding false-negative findings (in case of normal-appearing coronaries) or false-positive findings (in case of tentative plaques and stenoses).

The goal of avoiding false negative findings is mainly driven by the reported high negative predictive value of coronary CTA approximating 100%. Thus, every effort should be undertaken so as to not miss a single lesion.

The goal of avoiding false-positive findings is motivated by the aim of not lowering the positive predictive value of the CT study by misinterpreting artefacts or heavy calcifications. A false-positive CT study might lead to further invasive work-up that could have been avoided in case of a correct CT analysis and interpretation.

Avoiding false-negative findings

The algorithm for avoidance of false-negative findings is two-fold.

First, a close review of all vessel locations with a known high prevalence for coronary artery plaques and stenoses should be performed. It is known that in patients with stable clinical conditions (angina or unclear chest pain), the prevalence of coronary plaques is higher in the LAD and LCX than in the RCA. Segment-based analysis revealed the highest prevalence of plaques in the proximal and mid segments of the LAD and RCA, and in proximal and distal segments of the LCX (Fig. 4):; around two-thirds of coronary artery plaques and stenoses can be found in these segments. Thus, special consideration of these segments and bifurcations with a known high prevalence of stenoses is recommended even if the first analysis of the data revealed no evidence of coronary artery disease.

Second, three specific segments should be routinely reviewed using thick-slab MIP images to avoid missing a lesion after the initial evaluation:

1. The distal segment of the RCA and the origin of the PDA: the distal RCA travels longitudinally in the transverse images and the short axis plane, while the PDA commonly runs transverse in a cranial direction until reaching the posterior interventricular groove. Owing to this course in relation to the transverse orientation of the source images, stenosis assessment can sometimes be challenging in the small diameter vessels (Fig. 5).
2. The proximal and middle segment of the LAD curves transversally in the transverse and standard cardiac planes. The origin of the first diagonal branch, in particular, might be difficult to evaluate on those planes (Fig. 6).
3. The distal segment of the LCX near the origin of the obtuse marginal branch, which shows an angular course

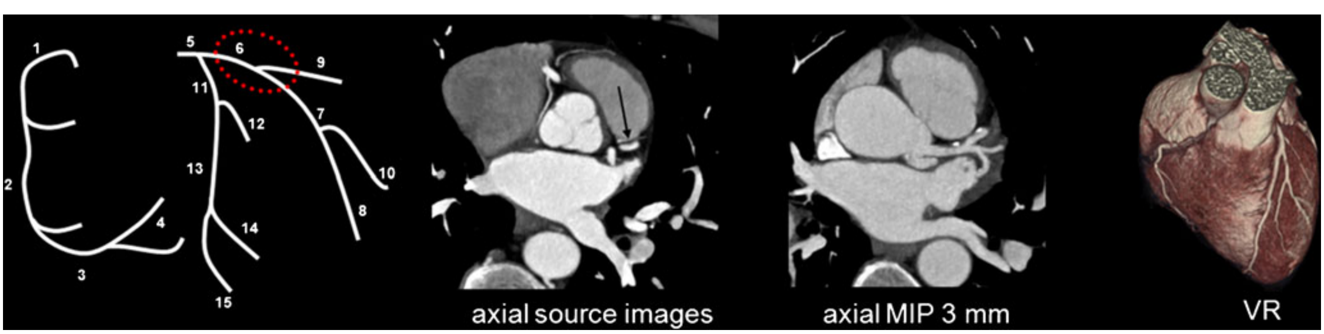


Fig. 6 Review segments and bifurcations where lesions are often missed: proximal and mid segment of the LAD (*MIP* maximum intensity projections, *VR* volume rendering)

Fig. 7 Review segments and bifurcations where lesions are often missed: distal segment of the LCX (*MIP* maximum intensity projections, *VR* volume rendering)

at the transverse source images and the standard cardiac planes (Fig. 7).

Note that the segments in nos. 2 and 3 are those with a commonly high prevalence of coronary artery stenosis (Figs. 6 and 7).

Avoiding false-positive findings

A potential pitfall in the assessment of coronary artery stenosis is to mistake a motion artefact for a noncalcified plaque. This might particularly occur in coronary CTA datasets of reduced image quality. One should always check a second reconstruction time-point for the presence of any noncalcified plaque. If the plaque is seen only on one of the reconstruction time-points, a motion artefact has to be expected mimicking the finding (Fig. 8).

Another important issue for distinguishing motion artefacts from true lesions is that any plaque has to be entirely visible on the reconstructed images [38]. This means that the plaque should be differentiated from the surrounding pericardial tissue around its entire circumference (Fig. 9). Otherwise, the "lesion" is suspicious as an artefact.

Degree of coronary stenosis

For all identified and verified plaques, the relevance of luminal narrowing must be evaluated. The degree of coronary stenosis is calculated as a ratio of the luminal diameter at the site of stenosis compared to a normal-appearing reference site in an adjacent proximal or distal vessel segment [39]. Care should be taken not to use a distal reference vessel that is also distal to a bifurcation. Such vessel segments have a naturally smaller calibre, and use of these as reference vessels could lead to overestimations of the degree of stenosis.

The stage of arteriosclerosis progression is frequently associated with remodelling of the arterial wall resulting in dilatation (positive remodelling) in earlier phases, and shrinkage (negative remodelling) of the vessel diameter in the later course of the disease [40]. Therefore one should avoid measurements of luminal narrowing in the stenosis compared to the wall-to-wall distance in the same position.

The most common cause of false-positive classifications is the presence of coronary artery wall calcifications. Such high-density structures cause beam-hardening, and blooming artefacts can result in overestimation of the degree of a stenosis [7]. In the presence of calcifications, routine reconstructions of an additional dataset with a sharper tissue

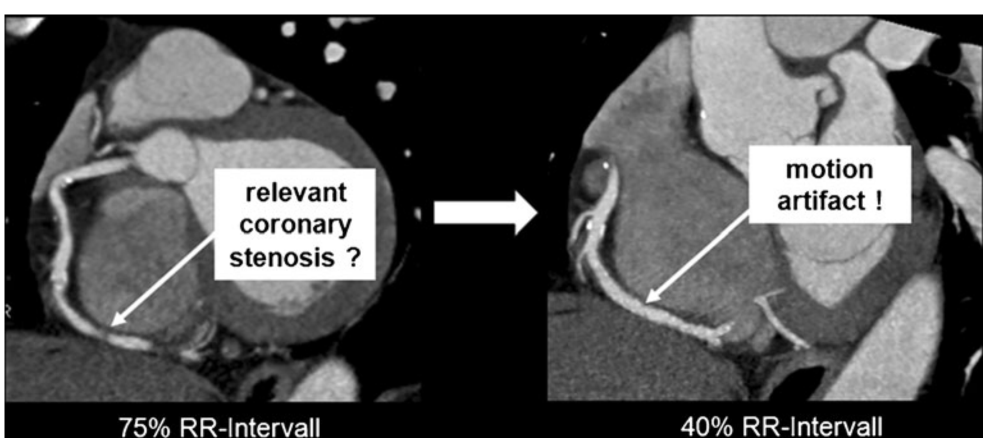


Fig. 8 Curved-planar reformations of the right coronary artery (RCA) at two different reconstruction time-points: At 75% of the R-R interval a noncalcified plaque in the distal RCA is suspected. Reviewing this area at 45% of the R-R interval shows no evidence of plaque, proving the "lesion" in diastole to be a motion artefact

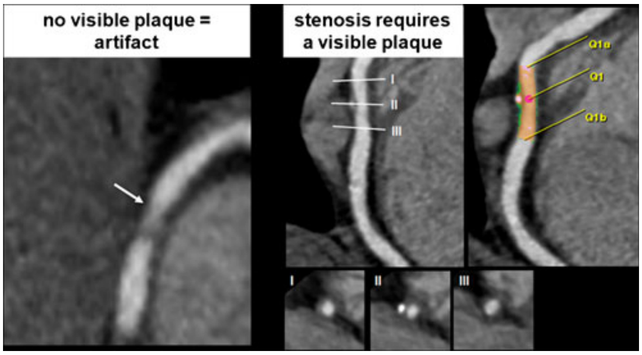


Fig. 9 *Left* Contrast filling defect in the coronary artery that might be considered as obstructive coronary lesion. The absence of a visible plaque and the lack of clear differentiation of the filling defect from the adjacent pericardial tissue suggest this "lesion" to be an artefact. *Right* Clearly visible mixed plaque in the coronary artery. Perpendicular views (*I–III*) show clear distinction from the pericardial tissue

convolution kernel and at bone window settings (window width around 1,400 HU, window center around 500 HU) help in reducing blooming artefacts from calcifications.

When plaques are identified and verified (see above), each lesion should be classified as being noncalcified, mixed (i.e., calcified and noncalcified), or purely calcified (Fig. 10). The use of new plaque classification schemes aimed at identifying unstable or advanced plaques (such as using the napkin-ring sign [41]) remains to be elucidated in future trials.

Evaluation of coronary artery stents

Coronary artery stenting represents the predominant procedure of nonsurgical myocardial revascularization. The assessment of in-stent restenosis remains challenging for noninvasive imaging. Although coronary CTA has made major advances over the last decade regarding the evaluation of coronary stent patency, the delineation of the coronary stent lumen can be difficult because of blooming and partial volume artefacts caused by the stent struts. In addition, image quality depends highly on the stent material and stent size as well as the stent's orientation in relation to the z-axis of the CT scanner. In general, these artefacts are reduced to some extent with more recent CT scanner technology [42, 43].

In general, the most reasonable approach in clinical practice is to perform coronary CTA selectively in only those patients in whom the stent type and size are known prior to CT (and are appropriate for coronary CTA) [42, 43].

Evaluation of coronary artery bypass grafts

Although invasive catheter angiography is still considered the standard of reference for the diagnosis of bypass graft stenosis and occlusion, coronary CTA is a valuable alternative modality for visualizing bypass grafts [44]. CT has the advantage of being less dependent on anatomical variations after surgery, where catheter angiography may fail due to lack of information about the proximal anastomoses of the grafts. In addition, during early postoperative surveillance, coronary CTA—as opposed to catheter angiography—provides not only information about the patency of bypass grafts, but also a comprehensive evaluation of possible surgery-related complications such as hematoma, effusions, or lung pathologies.

Reporting of imaging findings

A standardized template for reporting coronary CTA findings is encouraged. This template should be developed in conjunction with the main referring physicians for coronary CTA. The inclusion of schematic drawings as a synopsis of the most pertinent imaging findings should be considered (Fig. 11).

1. At the beginning of the findings section, the results from calcium scoring—if performed—describing the distribution (localized or diffuse) and the extent of calcifications (nodular or massive) in each coronary artery (i.e., left main, LAD, LCX, and RCA) should be mentioned.
2. The report should then continue describing the coronary anatomy, mentioning the presence or absence of anomalous coronary arteries, as well as the coronary artery supply type (right-dominant, left-dominant, or balanced type).

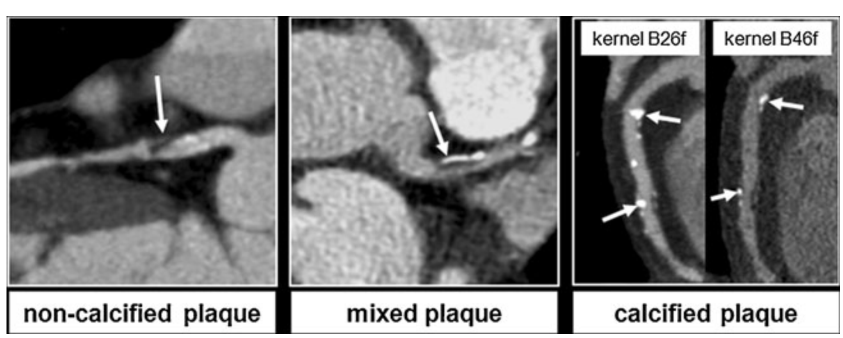


Fig. 10 Examples of different plaque types. Note for calcified plaques the lesser extent of blooming when using a sharp-tissue (B46f) compared to a soft-tissue kernel (B26f)

a

Name: [redacted]
Date of birth: [redacted]
Exam type: Cardiac CT
Exam date: [redacted]2007

page 1 of 4

[redacted]

Patient's history:
Systemic lupus erythematosus since 1991. Progressive dyspnea and inefficiency. Incidental atypical chest pain. Holosystolic murmur. Inconclusive transesophageal echocardiography.

Clinical question:
Relevant coronary artery disease? Valvular abnormalities?

Imaging findings:
Calcium scoring: Minor calcified plaque in the proximal LAD corresponding to an Agatston-Score of 8.

Coronary CT Angiography: Right-sided coronary supply type. Normal coronary anatomy. Normal RCA and LCX with absence of coronary artery plaques. Minor calcified coronary artery plaque in the proximal LAD; remaining segments of LAD are normal. No relevant coronary artery stenosis.

Cardiac function:
Normale left-ventricular function (ejection fraction, 58%). Normal left-ventricular wall movement. Normal left-ventricular cardiac mass (84 gram/sqm).

Cardiac valves:
Focal thickening of the anterior mitral leaflet with two nodular masses at the 7 / 8 h position. Markedly thickening of the anterior tendinous chords. Reduced mobility of the anterior mitral leaflet. Moderate mitral regurgitation with regurgitant orifice area of 0.3 sqcm at planimetric measurement.
Diffuse thickening of the aortic valve leaflets. Minore aortic regurgitation with regurgitant orifice area of 0.2 sqcm at planimetric measurement.

Extra-cardiac structures:
Normal lung parenchyma in the scan volume. Normal lymph nodes and osseous structures.

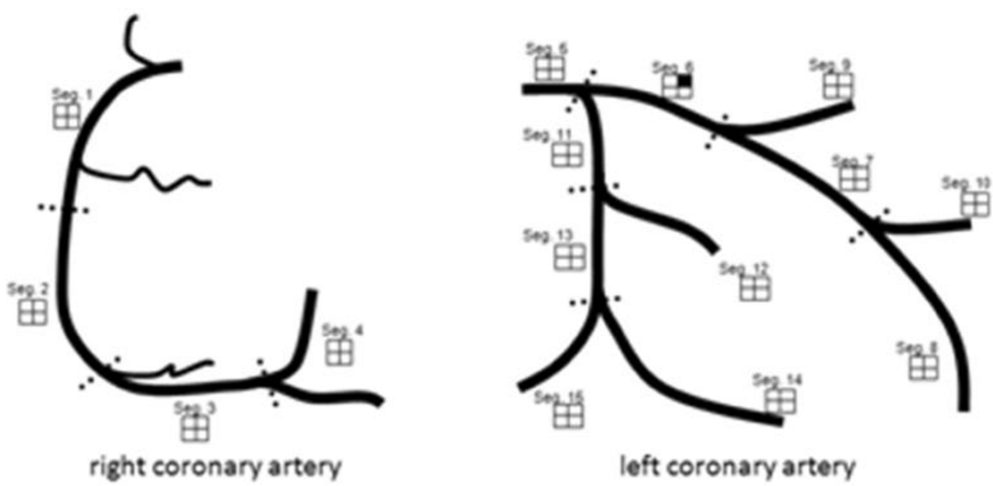


Fig. 11 Example of a coronary CTA report

b

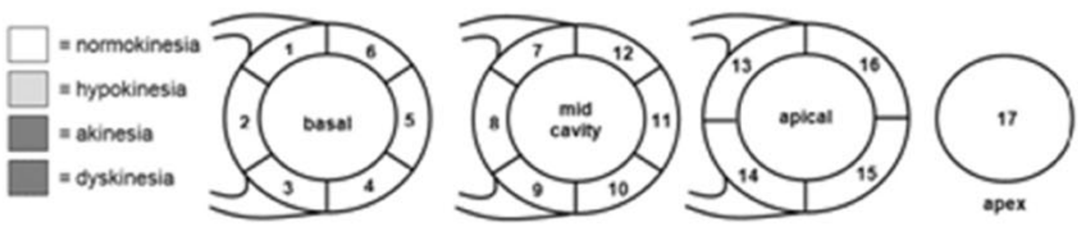
Name: [redacted]
Date of birth: [redacted]
Exam type: Cardiac CT
Exam date: [redacted] 2007

page 2 of 4 [redacted]

Summary statement:

- Right-sided coronary supply type.
- Single coronary calcification in the proximal LAD (Agatston score of 8) corresponding to the 25^{th} to 50^{th} percentile of calcium score for men within age strata.
- No relevant coronary artery stenosis.
- Normal left-ventricular function (ejection fraction, 58%) and wall motion.
- Moderate mitral regurgitation (ROA, 0.3 sqcm) and focal thickening of the anterior mitral leaflet with two small nodular masses and thickening of the anterior tendinous chords; Imaging findings are highly suggestive of cardiac manifestation of known SLE (Libman-Sacks endocarditis).
- Minor aortic regurgitation (ROA, 0.2 sqcm) and minor thickening of aortic cusps.

[redacted], MD [redacted], MD



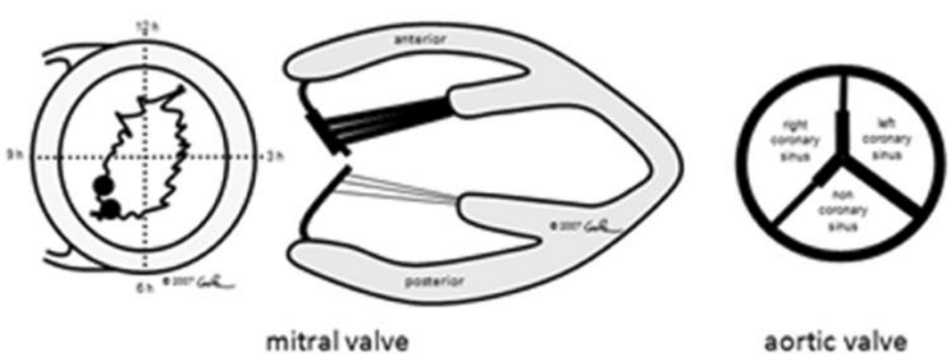


Fig. 11 (continued)

Fig. 11 (continued)

3. Each coronary artery is separately commented on with regard to the presence and type of plaques (i.e., non-calcified, mixed, or calcified).
4. Semiquantitative reporting of the degree of stenosis using the terms mild (less than 30% luminal narrowing), moderate (30–50%), moderate to severe (50–75%), and

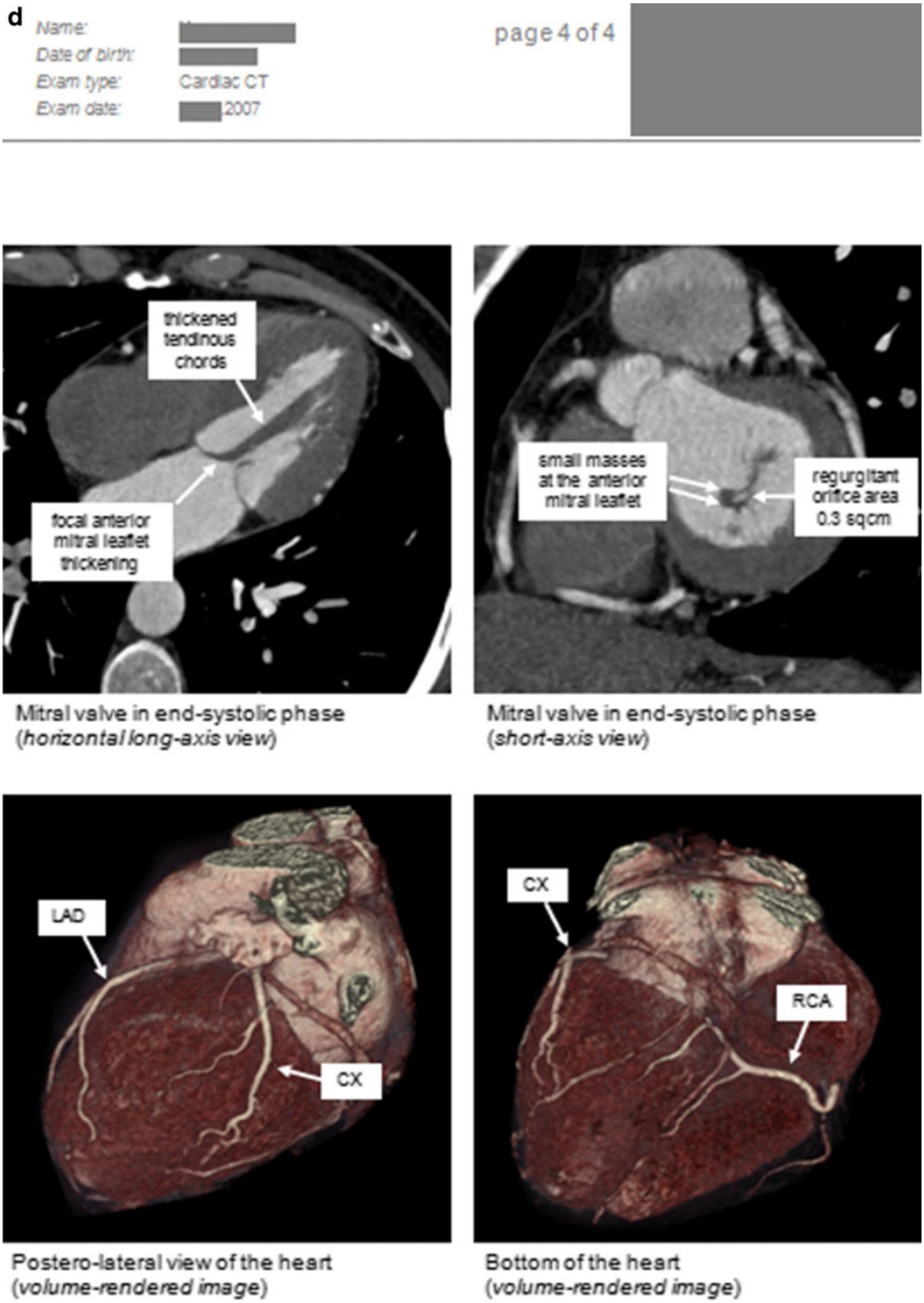


Fig. 11 (continued)

severe stenosis (more than 75%) represents the central information of the coronary CTA finding section. When coronary artery bypass grafts are present, the type, origin, and course, the site of the anastomoses, as well as the location and degree of graft stenosis, if present, should be reported. Care should be taken to include a note on the presence of possible jump-anastomoses.

5. The next section is dedicated to information about other, noncoronary cardiac findings such as the morphology of the valves, aortic root, size of the pulmonary trunk and arteries, the ventricular and atrial septum, as well as the presence of myocardial disease (such as areas of infarction, scars, or aneurysm formation).
6. The last section is devoted to extra-cardiac findings in the mediastinum, lung, and chest wall, including the analysis of the images from the upper abdomen.

Representative image examples provided to the referring physician include curved-planar or oblique reformations of the main coronary arteries with all relevant findings. VR images can be added to further illustrate the findings in an intuitive and understandable manner. VR images are particularly helpful for communicating imaging findings to referrers and patients.

Conclusions

Coronary CTA offers many advantages to patients and referrers by providing an accurate and comprehensive evaluation of the coronary arteries and vessel wall in a noninvasive manner. The continuous increase in examinations performed worldwide necessitates a standardized and systematic approach for analyzing and interpreting coronary CTA studies to keep the awareness of potential pitfalls high. Standardized reporting of the pertinent findings to the referring physician, along with a selection of representative images using various post-processing tools helps to achieve and maintain the high diagnostic capabilities of this growing new imaging test.

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